Missouri Department of Health and Senior Services

Hazardous Substances Emergency Events Surveillance (HSEES) Program

2002 - 2003 Data Analysis

Table of Contents

Table of Contents

EXECUTIVE SUMMARY

The Hazardous Substances Emergency Events Surveillance (HSEES) system, maintained by the Agency for Toxic Substances and Disease Registry (ATSDR), actively collects information to describe the public health consequences of releases of hazardous substances in 15 states. This report summarizes the characteristics of events reported to the Missouri Department of Health and Senior Services (MDHSS) in 2002 and 2003. Information about acute events involving hazardous substances were collected, including the substance(s) released, number of victims, number and types of injuries, and number of evacuations. The data was computerized using an ATSDR-provided Web-based data entry system.

During 2002 and 2003, a total of 824 events were reported. In 701 (86%) events, only one substance was released. The most commonly reported categories of substances were volatile organic compounds, acids, other inorganic substances and ammonia. During this reporting period, 262 events (32% of all reported events) resulted in a total of 524 victims, of whom 8 (2%) died. The most frequently reported injuries were respiratory, headache, eye irritation and chemical burns. Evacuation was ordered for 78 (30%) events.

The findings regarding the percentages of events with victims and events with evacuations and the distributions of the numbers and types of injuries reported have been increasing.

INTRODUCTION

The Centers for Disease Control and Prevention defines surveillance as

> "ongoing, systematic collection, analysis, and interpretation of health data essential to the planning, implementation, and evaluation of public health practice, closely integrated with the timely dissemination of these data to those who need to know. The final link of the surveillance chain is the application of these data to prevention and control. A surveillance system includes a functional capacity for data collection, analysis, and dissemination linked to public health programs" [1].

Since 1990, the Agency for Toxic Substances and Disease Registry (ATSDR) has maintained an active, state-based Hazardous Substances Emergency Events Surveillance (HSEES) system to describe the public health consequences of releases of hazardous substances. The decision to initiate a surveillance system of this type was based on a study published in 1989 about the reporting of hazardous substances releases to three national databases: the National Response Center Database, the Hazardous Material Information System (HMIS), and the Acute Hazardous Events Database [2]. A review of these databases indicated limitations. Many events were missed because of specific reporting requirements (for example, the HMIS did not record events involving intrastate carriers or fixed-facility events). Other important information was not recorded, such as the demographic characteristics of victims, the types of injuries sustained, and the number of persons evacuated. As a result of this review, ATSDR implemented the HSEES system to more fully describe the public health consequences of releases of hazardous substances. HSEES has four goals:

- To describe the distribution and characteristics of acute hazardous substances releases;
- To describe morbidity and mortality among employees, responders, and the general public that resulted from hazardous substances releases;
- To identify risk factors associated with the morbidity and mortality; and
- To identify strategies that might reduce future morbidity and mortality resulting from the release of hazardous substances.

For a surveillance system to be useful, it must not only be a repository for data, but also useful to protect public health.

In the last few years, the fourth goal of the HSEES system has been emphasized; i.e., to develop strategies to reduce subsequent morbidity and mortality by having each participating state analyze its data and develop appropriate prevention outreach activities. These activities are intended to provide industry, responders, and the general public with information that can help prevent chemical releases and reduce morbidity and mortality if a release occurs.

This report provides an overview of HSEES for 2002-2003 in Missouri, summarizes the characteristics of acute releases of hazardous substances and their associated public health consequences, and demonstrates how data from the system are translated into prevention activities to protect public health.

METHODS

Beginning in 2002, a newly updated data-collection form, approved by the Office of Management and Budget, went into effect. For each event, information was collected about the event, substance(s) released, victims, injuries, and evacuations.

Various data sources were used to obtain information about these events. These sources included, but were not limited to, Missouri Department of Natural Resources (DNR), United States Coast Guard, National Response Center (NRC), MDHSS Bioterrorism Surveillance, United States Department of Transportation (DOT) Hazardous Materials Information System (HMIS), Missouri State Highway Patrol (MSHP), private companies and Missouri Press Clipping Bureau (media). Census data were used to estimate the number of residents in the vicinity of the events. All data were computerized using a web-based data entry system provided by ATSDR.

HSEES defines hazardous substances emergency events as uncontrolled or illegal releases or threatened releases of hazardous substances. Events involving releases of only petroleum are not included. Events are included if (1) the amount of substance released (or that might have been released) needed (or would have needed) to be removed, cleaned up, or neutralized according to federal, state, or local law; or (2) the release of a substance was threatened, but the threat led to an action (for example, evacuation) that could have affected the health of employees, emergency responders, or members of the general public. HSEES defines victims as people who suffer at least one adverse health effect within 24 hours of the event, or who die as a consequence of the event. Victims who receive more than one type of injury are counted once in each applicable injury type. Events are defined as transportation-related if they occur during surface, air, pipeline, or water transport of hazardous substances, or before being unloaded from a vehicle or vessel. All other events are considered fixed-facility events.

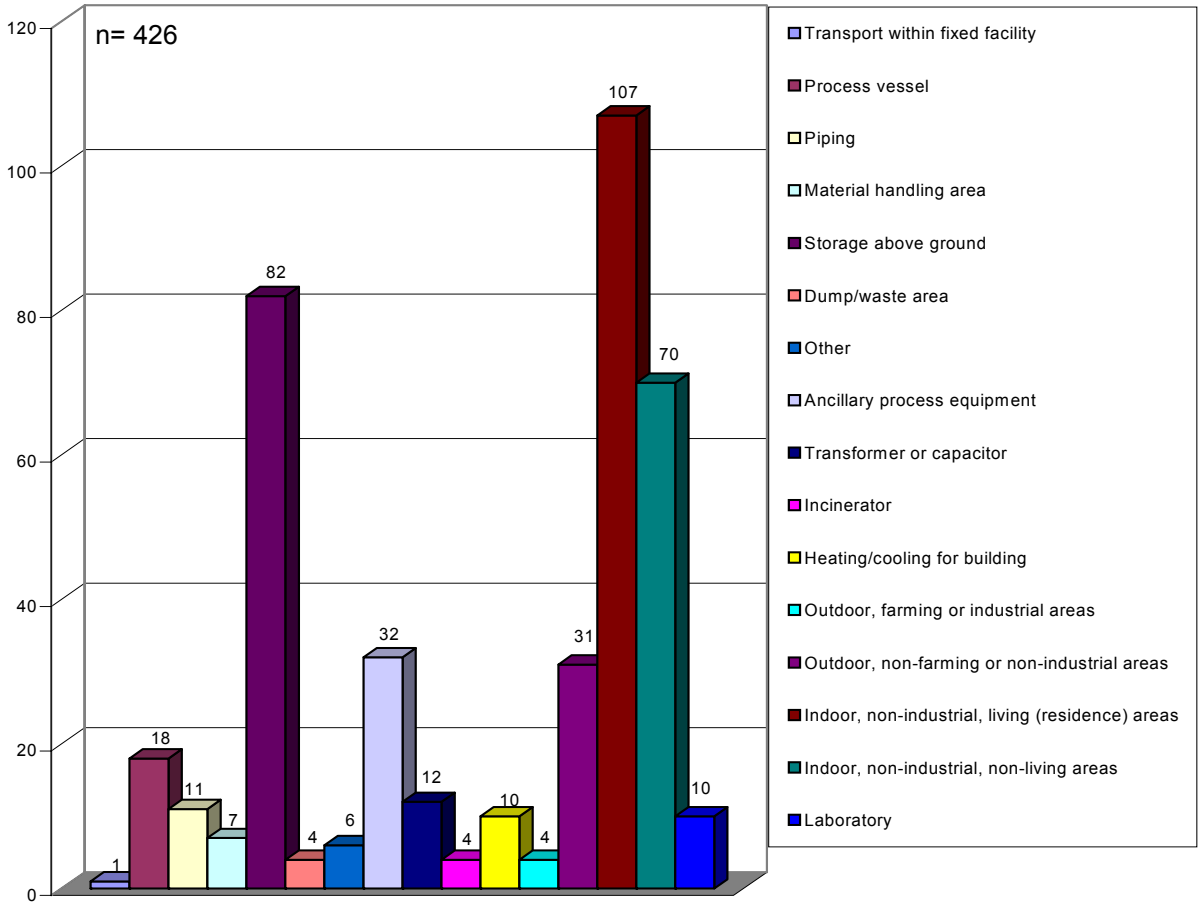
For the data analyses in this report, the substances released were categorized into 16 groups. The category “mixture” comprises substances from different categories that were mixed before the event, and the category “other inorganic substances” comprises all inorganic substances, except acids, bases, ammonia, and chlorine.

RESULTS

For 2002-2003, 824 hazardous substances emergency events were reported to HSEES: 6 (0.73%) of these events were threatened releases, 3 (0.36%) were both actual and threatened releases. A total of 426 (52%) occurred in fixed facilities.

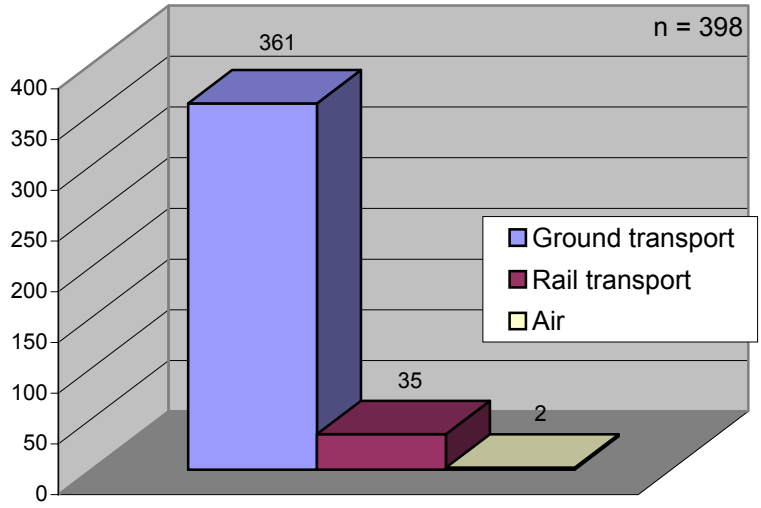
For each fixed-facility event, one or two types of area involved in the release can be selected. Of all 426 fixed-facility events, 409 (96%) had one type of area; 10 (2%), a combination of two area types, and 7 (2%), no type of area reported. Among events with one type of area reported, the main area was classified as follows: 107 (26%) indoor, non-industrial, living (residence), 82 (20%) storage areas above ground (i.e., tank, storage shed, and warehouse), 70 (17%) indoor, non-industrial, non-living and 32 (8%) ancillary processing equipment (Figure 1).

Figure 1. - Fixed-facility events by area type, Missouri Hazardous Substances Emergency Events Surveillance, 2002-2003.



Of the 10 events with two areas, 4 (40%) involved ancillary processing equipments in combination with other types of area. Of the 398 transportation-related events, 361 (91%) occurred during ground transport (e.g., truck, van, or tractor), and 35 (9%) involved transport by rail (Figure 2).

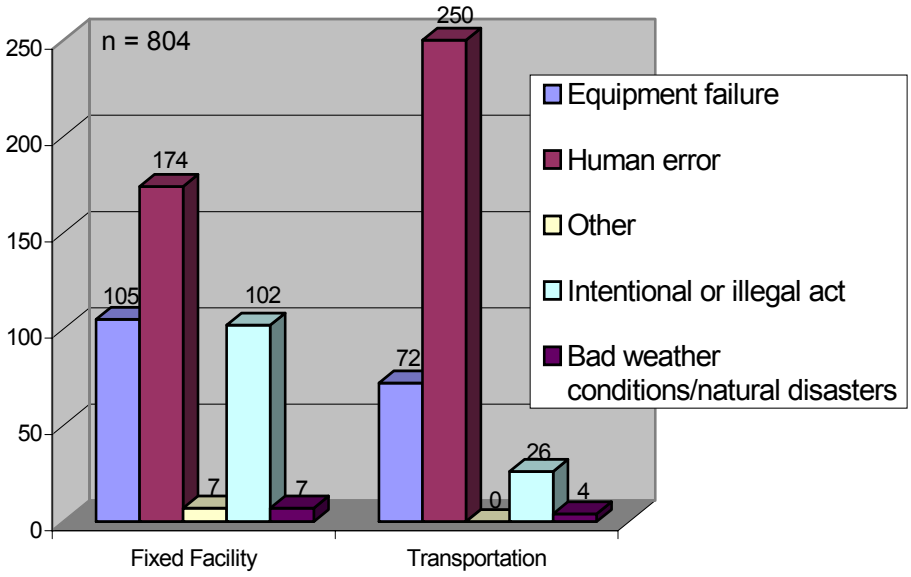
Figure 2. - Transportation-related events by mode of transportation, Missouri Hazardous Substances Emergency Events Surveillance, 2002-2003.



Fewer events involved water, air, and pipeline transportation modes. The largest proportion of transportation-related events occurred during unloading of a stationary vehicle or vessel (182, 46%) and releases from a moving vehicle or vessel (98, 25%).

Factors contributing to the events consisted of primary and secondary entries and were reported for 804 (98%) events. Of reported factors, 174 (22%) of fixed-facility events and 250 (31%) of transportation-related events involved human error as the primary factor; 105 (13%) of fixed-facility and 72 (9%) of transportation-related events involved equipment failure as the primary factor (Figure 3).

Figure 3. - Primary cause of release by event type, Missouri Hazardous Substances Emergency Events Surveillance, 2002-2003.



Of the 818 events involving actual releases, 701 (86%) involved the release of only one substance. Two substances were released in 46 (6%) events, and 71(9%) involved the release of more than two substances (Table 1). Fixed-facility events were more likely than transportation events to have two or more substances involved in an event (76% vs. 24%).

Table 1. - Number of substances involved per event, by type of event, Missouri Hazardous Substances Emergency Events Surveillance, 2002-2003.

No. substances	Type of event						All events		
	Fixed facility			Transportation					
	No. events	%	Total substances	No. events	%	Total substances	No. events	%	Total substances
1	332	79%	332	369	93%	369	701	86%	701
2	30	7%	60	16	4%	32	46	6%	92
3	35	8%	105	10	3%	30	45	6%	135
4	21	5%	74	1	.3%	4	22	3%	88
≥ 5	21	1%	21	1	.3%	23	4	.5%	44
Total	**421**	**100%**	**602**	**397**	***100.6%**	**458**	**818**	***101.5%**	**1060**

***Percentage does not equal 100% due to rounding.

A total of 1076 substances were either released or threatened to be released during the events. Two types of releases for each chemical (e.g., spill and air) could be reported. Of a total of 1060 substances having type of release reported, only one type of release was associated with the following: air releases (396, 37%), spills (525, 50%), fires (15, 1%), and explosions (7, 0.7%). Two types of releases were reported for the following combinations: spills and air releases (84, 8%), and fires and explosions (5, 0.5%); the remainder involved other combinations of release types, or unknown release types.

The number of events by month ranged from 55 (7%) in December to 90 (11%) in June, with the largest proportions occurring from June-August/Summer. The proportion of events ranged from 123 (15%) to 143 (17%) during weekdays, and from 72 (9%) to 78 (9%) during weekend days. Of all 711 (86%) events for which time of day or time category was reported, 228 (32%) occurred from 6:00 a.m. to 11:59 a.m., 215 (30%) from 12:00 p.m. to 5:59 p.m., 139 (20%) from 6:00 p.m. to 11:59 p.m., and the remainder during the early hours of the day.

Industries

The largest proportions of HSEES events were associated with the transportation type of Industry 316 (38%) and the manufacturing type of industry 134 (16%) industries (Table 2).

Table 2. - Industries involved in hazardous substances events, by category, Missouri Hazardous Substances Emergency Events Surveillance, 2002-2003.

Industry category	Total events		Events with victims		Percentage all events with victims in industry category	Total no. victims # (range)*
	No.	%	No.	%		
Agriculture	15	2%	4	2%	27%	6 (1-3)
Mining	0	0%	0	0%	0%	0
Construction	9	1%	2	.8%	22%	2 (1)
Manufacturing	134	16%	39	15%	29%	120 (1-67)
Transportation	316	38%	23	9%	7%	34 (1-9)
Communications	1	0.1%	1	0.4%	100%	3 (3)
Utilities	31	4%	5	2%	16%	8 (1-4)
Wholesale trade	42	5%	11	4%	26%	33 (1-10)
Retail trade	20	2%	11	4%	55%	17 (1-5)
Finance	3	0.4%	2	1%	67%	10 (2-8)
Business and repair services	5	.6%	3	1%	60%	7 (1-5)
Personal services	69	8%	49	19%	71%	89 (1-11)
Entertainment	4	0.5%	1	0.4%	25%	1 (1)
Professional services	39	5%	24	9%	62%	54 (1-12)
Public administration	12	2%	5	2%	42%	5 (1)
Unspecified and unknown	40	5%	24	9%	60%	40 (1-4)
Abandoned (dumped on highway or other property)	1	.1%	0	0%	0%	0
Private vehicle	3	.4%	0	0%	0%	0
Illegal activity (non-meth related) – private property, n.e.c.	2	.2%	0	0%	0%	0
Illegal activity (non-meth related) – school	1	.1%	0	0%	0%	0
Illegal activity (non-meth related) – other/unspecified location	2	.2%	1	.4%	50%	2(2)
Illegal activity (meth related) – farm/ agricultural facility	12	2%	2	.8%	17%	6 (2-4)
Illegal activity (meth related) – hotel/motel	1	.1%	0	0%	0%	0
Illegal activity (meth related) – private residence	40	5%	38	15%	95%	58 (1-6)
Illegal activity (meth related) – private vehicle	16	2%	12	5%	75%	23 (1-5)
Illegal activity (meth related) – other/ unspecified location	6	.7%	5	2%	83%	6 (1-2)
Total	**824**	**100%**	**262**	****101.8%**	**-**	**524 (1-67)**

*Range of number of victims per event with victims. **Percentage does not equal 100% due to rounding.

However, the largest proportion of events with injuries occurred in the personal services industry (49, 19%). The number of victims in the manufacturing industry (39, 15%) was followed by the number of victims in the illegal activity (meth-related) private residence (38, 15%) and the professional services industry (24, 9%) and where the industry was unspecified/unknown (24, 9%). The industry with the most events may not necessarily be the most likely to result in victims. For example, the transportation industry was involved in 316 events; however, only 23 of these events (7%) resulted in adverse health effects. Conversely, the personal services industry was involved in only 69 events, and 49 of these events (71%) resulted in adverse health effects, indicating its greater potential for immediate harm.

Substances

A total of 1076 substances were involved in all events, of which 16 (1%) were reported as threatened releases. The substances most frequently released were Ammonia, Hydrochloric Acid, Ethyl Ether, and Acetone (Appendix A). These substances were grouped into 16 categories. The categories most commonly involved in fixed-facility events were ammonia (113, 19%), acids (102, 17%), and volatile organic compounds (97, 16%). In transportation-related events, the most common releases were volatile organic compounds (77, 17%), acids (63, 14%), and other inorganic substances (56, 12%) (Table 3).

Table 3. - Number of substances involved, by substance category and type of event, Missouri Hazardous Substances Emergency Events Surveillance, 2002-2003.

Substance category	Type of event				All events	
	Fixed facility		Transportation			
	No. substances	%	No. substances	%	No. substances	%
Acids	102	17%	63	14%	165	16%
Other*	57	9%	40	9%	97	9%
Mixture†	18	3%	33	7%	51	5%
Ammonia	113	19%	27	6%	140	13%
Bases	26	4%	36	8%	62	6%
Chlorine	17	3%	5	1%	22	2%
Other inorganic substances‡	94	16%	56	12%	150	14%
Paints & dyes	11	2%	28	6%	39	4%
Pesticides	21	3%	39	9%	60	6%
Polychlorinated biphenyls	12	2%	0	0%	12	1%
Volatile organic compounds	97	16%	77	17%	174	16%
Formulations	2	0.3%	1	.1%	3	.3%
Hetero-Organics	0	0%	6	1%	6	1%
Hydrocarbons	4	1%	4	1%	8	1%
Oxy-Organics	27	4%	23	5%	50	5%
Polymers	1	.2%	20	4%	21	2%
Total**	**602**	****99.5%**	**458**	**100%**	**1060**	****101.3%**

* Not classified. **Percentage does not equal 100% due to rounding. † Substances from different categories that were mixed prior to the event. ‡ All inorganic substances except for acids, bases, ammonia and chlorine.

Victims

A total of 524 victims were involved in 262 events (32% of all events) (Table 4). Of the events with victims, 170 (65%) events involved only one victim, and 55 (21%) involved two victims. Of all victims, 347 (66%) were injured in fixed-facility events. Fixed-facility events were more likely to have more than one victim per event (67, 26%) than were transportation events (25, 10%).

Table 4. - Frequency of the number of victims by type of event, Missouri Hazardous Substances Emergency Events Surveillance, 2002-2003.

No. victims	Type of event						All events		
	Fixed facility			Transportation					
	No. of events	%	Total victims	No. of events	%	Total victims	No. of events	%	Total victims
1	134	67%	134	36	59%	36	170	65%	170
2	39	19%	78	16	26%	32	55	21%	110
3	13	6%	39	3	5%	9	16	6%	48
4	6	3%	24	1	2%	4	7	3%	28
5	3	1%	15	2	3%	10	5	2%	25
≥ 6	6	3%	57	5	5%	86	9	3%	143
Total	**201**	***99%**	**347**	**61**	**100%**	**117**	**262**	**100%**	**524**

*Percentage does not equal 100% due to rounding.

To represent the magnitude of the effects of substances involved in injuries, the number of events in a specific substance category was compared with the number of events in the same category that had victims. Substances in events that involved one or more substances from the same substance category were counted once in that category. Substances in events that involved two or more substances from different categories were counted once in the multiple-substance categories. Substances released most often were not necessarily the most likely to result in victims (Table 5). For example, events involving the substance category “ammonia” constituted 14% of all events. However, only 12 % of these events resulted in injuries. Conversely, events involving formulations and multiple substance categories exclusively comprised .2 % and 12% of all events respectively, but 100% of these 2 events and 88% of 101 events resulted in injuries.

Table 5. - Frequency of substance categories in all events and events with victims, Missouri Hazardous Substances Emergency Events Surveillance, 2002-2003.

Substance category*	All events		Events with victims		
	No.	%	No.	Percentage of all releases with victims	Percentage of events with victims in substance category
Acids	88	11%	20	8%	22%
Other†	56	7%	18	7%	32%
Mixture‡	43	5%	13	5%	30%
Ammonia	111	14%	32	12%	29%
Bases	50	6%	13	5%	26%
Chlorine	16	2%	8	3%	50%
Other inorganic substances¶	84	10%	19	7%	23%
Paints & dyes	36	4%	2	.8%	6%
Pesticides	48	6%	9	3%	19%
Polychlorinated biphenyls	12	2%	0	0	0
Volatile organic compounds	98	12%	20	8%	20%
Multiple substance categories	101	12%	89	34%	88%
Formulations	2	.2%	2	.8%	100%
Hetero organics	4	.5%	0	0	0
Hydrocarbons	8	1%	3	1%	38%
Oxy-organics	43	5%	13	5%	30%
Polymers	18	2%	1	.4%	6%
Total	**818**	****99.7%**	**262**	**100%**	**-**

*Substances in events that involved multiple substances were counted only once in a substance category when all the substances were associated with the same category. If events that involved multiple substances from different substance categories they were counted only once in the multiple substance categories.
†Not classified.
‡Substances from different categories that were mixed prior to the event.
¶All inorganic substances except for acids, bases, ammonia, and chlorine.
**Percentage does not equal 100% due to rounding.

Responders (204, 39%) constituted the largest proportion of the population groups injured, followed by employees (147, 28%) of which two are members of a company response team, members of the general public (135, 26%) and students (35, 7%) (Figure 4). 150 emergency response personnel were injured in fixed-facility events. Of those, 137 (92 %) were police officers, 10 (7%) were career firefighters, and 1 (1%) was a firefighter that was unspecified. 56 emergency-responder victims were injured in transportation-related events. Of these, most (48, 86%) were police officers. Police officers were more frequently victims in fixed facility-related events than in transportation-events (Figure 5).

Figure 4. - Number of victims by victim category, Missouri Hazardous Substances Emergency Events Surveillance, 2002-2003.

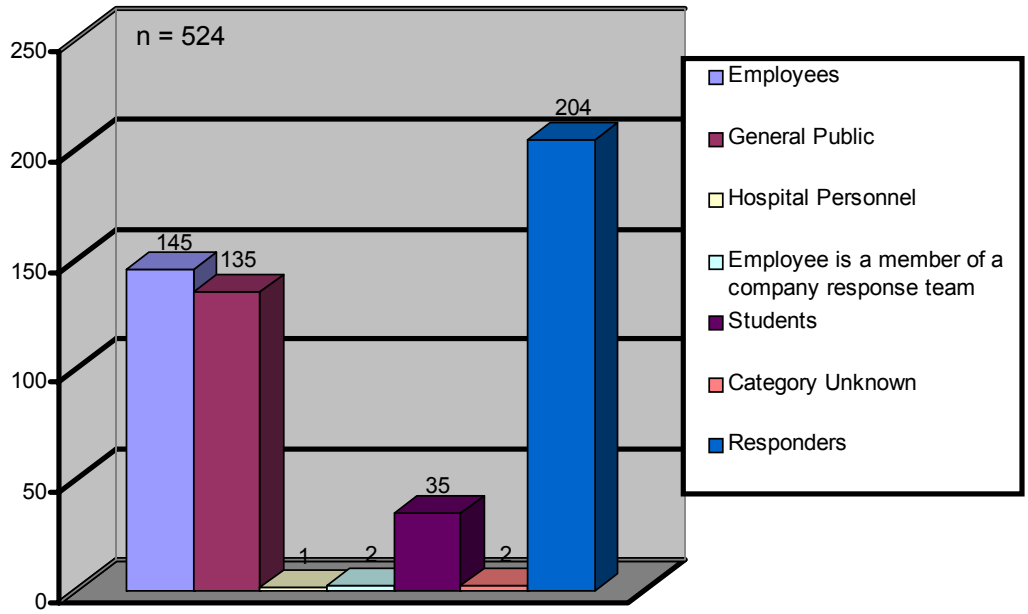
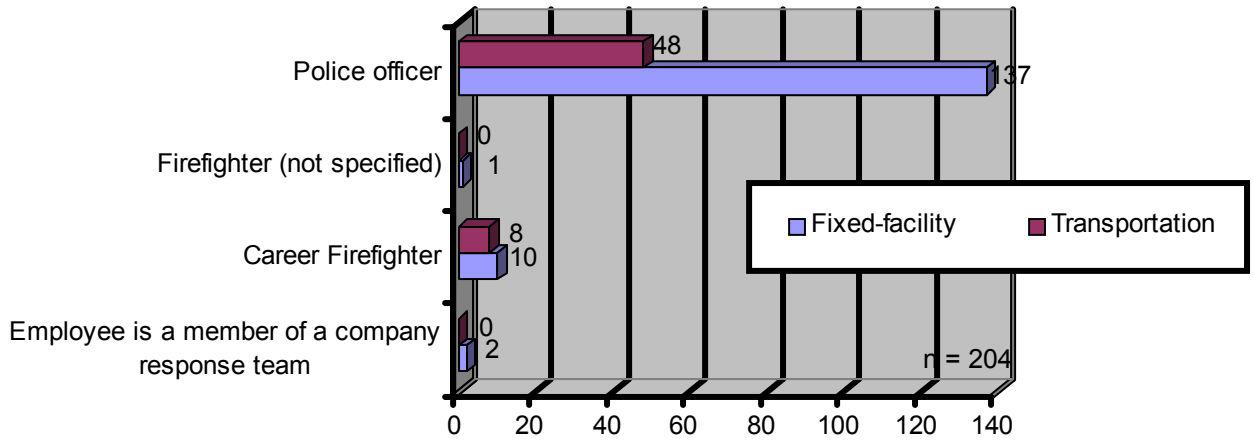


Figure 5. - Emergency response personnel by event type and victim category, Missouri Hazardous Substances Emergency Events Surveillance, 2002-2003.



Victims were reported to sustain a total of 691 injuries (Table 6). Some victims had more than one injury. Of all reported injuries and symptoms, those most common in fixed-facility events were respiratory (174, 35%), headache (110, 22%), eye irritation (54, 11%), other (36, 7%), chemical burns (33, 7%) and gastrointestinal system (26, 5%). In transportation-related events, respiratory (98, 50%), headache (40, 20%), trauma (31, 16%) and chemical burns (10, 5%) were reported most frequently. In a large proportion of the instances, trauma might have resulted from a chain of events, such as a motor vehicle accident, leading to the release of a hazardous substance, and not necessarily by the exposure to the substance itself.

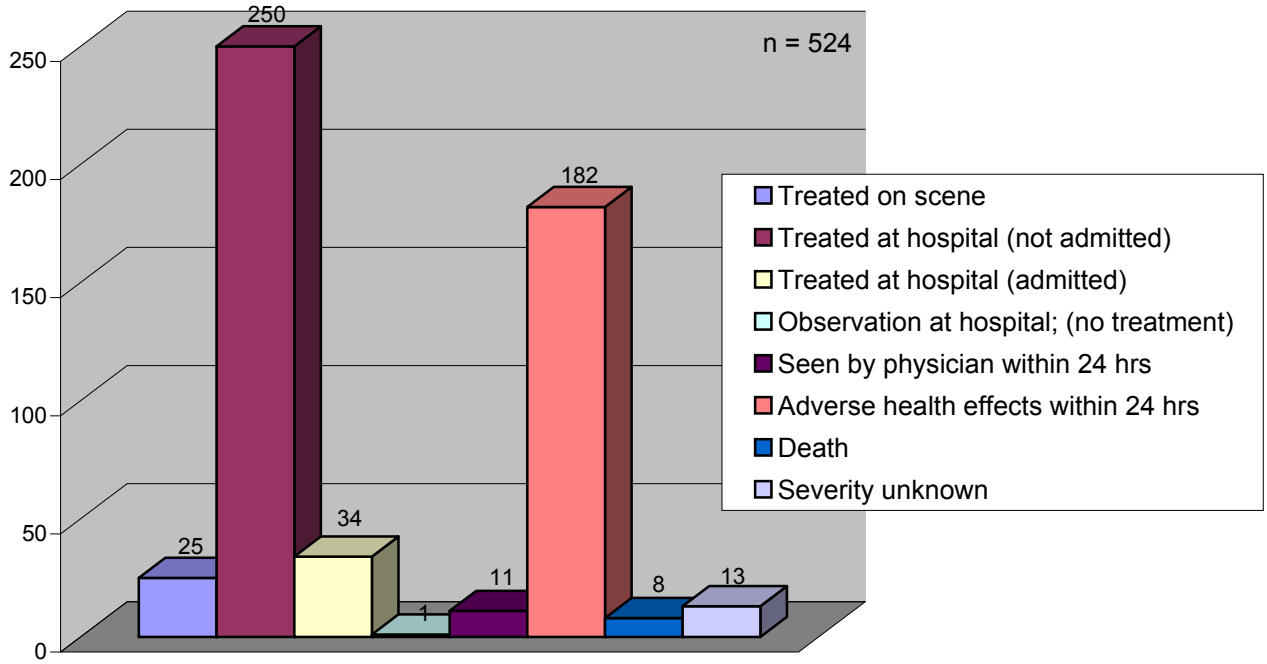
Table 6. - Frequencies of injuries/symptoms, by type of event, Missouri Hazardous Substances Emergency Events Surveillance, 2002-2003.

Injury/symptom	Fixed facility		Transportation		All events	
	No. injuries	%	No. injuries	%	Total no.	%
Trauma	17	3%	31	16%	48	7%
Respiratory	174	35%	98	50%	272	39%
Eye	54	11%	5	3%	59	9%
Gastrointestinal system	26	5%	4	2%	30	4%
Heat stress	1	0.2%	0	0%	1	0.1%
Chemical burns	33	7%	10	5%	43	6%
Other	36	7%	0	0%	36	5%
Skin	20	4%	6	3%	26	4%
Dizziness or other central nervous system	23	5%	2	1%	25	4%
Headache	110	22%	40	20%	150	22%
Heart problems	0	0%	0	0%	0	0%
Shortness of breath	1	.2%	0	0%	1	0.1%
Total†	**495**	****99.4%**	**196**	**100%**	***691**	****100.2%**

*The number of injuries is greater than the number of victims (524) because a victim could have had more than one injury.
**Percentage does not equal 100% due to rounding.

Sex was known for 413 (79%) of the victims; of these 285 (69%) were males. Males constituted 59% of all employees and responders for whom sex was reported. The median age of the 288 (55%) victims for whom age was reported was 34 years (range: 2-74). Of these, 7 were children ages <10 years, and 9 were children ages 10 - 18 years. For the 236 (45%) injured persons for whom age was not reported, 204 (86%) were presumably adults (first responders and employees), 16 (7%) were students, and 16 (7%) could have been adults or children (members of the general public or the category of victims was not known). The largest proportion of victims (severity/disposition) 250 (48%) were treated and released from a hospital; 182 (35%) had adverse health effects experienced within 24 hours of the event reported by an official, and 8 (2%) died (Figure 6).

Figure 6. - Victims by severity of adverse health effects, Missouri Hazardous Substances Emergency Events Surveillance, 2002-2003.



The status of personal protective equipment (PPE) use was reported for 146 (28%) employees and for 176 (34%) first-responder victims. Most of the employees 127 (87%) and 30% of first responders had not worn any form of PPE. Employees who wore PPE most often used gloves and eye protection (13, 17%). Among first responders who wore PPE, 111 (76%) wore gloves; 20 (14%) wore PPE but the type was not reported; 2 (1%) wore Level C PPE and 2 (1%) wore firefighter turn-out gear with respiratory protection.[a] Of the 176 responders with a known (or reported) PPE status, 134 (72%) were officers responding to events related to production of methamphetamine.

EVACUATIONS

Evacuations were ordered in 78 (30%) events where evacuation status was reported. Of these evacuations, 50 (64%) were of a building or the affected part of a building; 18 (25%) were of a defined circular area surrounding the event locations; and the remainder were of a downwind or downstream area, a circular and downwind or downstream area, of no criteria, or not known. The number of people evacuated was known for 62 events and ranged from 1 to 400 people, with a median of 20. However, one ordered evacuation was reported as having no evacuees. The median length of evacuation was 2 hours. In all events for which evacuation was ordered, access to the area was restricted. Five events had in-place sheltering ordered by an official.

[a]Note: Firefighter turn-out gear is protective clothing normally worn by firefighters during structural fire-fighting operations and is similar to level “D” protection. Level “D” as defined by the Occupational Safety and Health Administration is coveralls, boots/shoes (leather of chemical resistant, steel toe and shank), safety glasses or chemical splash goggles, and hard hat. Level “D” provides limited protection against chemical hazards.

RESPONSE

States could report up to 10 categories of "who responded" to the event. At least one response category was reported for 785 (95%) events. Of these events, 286 (36%) had 2 or more categories reported, 128 (16%) had 3 or more categories reported, 58 (7%) had four or more categories reported, 22 (3%) had 5 or more categories reported, 5 events had 6 categories reported, and 3 events reported 7 categories.

The distribution of the 10 response categories are as follows:

Company's response team	61.5%
Certified HazMat team	7.9%
Fire Department	29.9%
Law enforcement agency	31.1%
Environmental agency	10.8%
EMT	10.4%
Hospital personnel	0.4%
'Other'	17.6%
Health Department	0.1%
EPA response team	1.4%
***Total**	**171.1%**

* Percentages sum to greater than 100% because an event can report multiple categories.

PREVENTION ACTIVITIES

During 2002-2003 the Missouri HSEES program performed various prevention activities. These activities included:

- Acquisition, cleaning and geocoding of data for use with the ATSDR Geographic Information System (GIS) mapping system
- Contracts with Local Emergency Planning Committees (LEPCs) for educational presentations
- Analysis of methamphetamine events resulting in injuries to law enforcement personnel
- 2001 and 2002 event summary reports by county
- Distribution of ATSDR's "Managing Hazardous Materials Incidents" guidelines on CD-ROM to Missouri hospitals with emergency treatment facilities
- Quarterly reports of 10 counties with highest number of events, 1999-2001
- Missouri hospital needs assessment on chemical preparedness

The Missouri HSEES Internet website page is available at www.dhss.mo.gov/hsees. At this site, annual reports and other information can be printed.

METHAMPHETAMINE IN MISSOURI

During calendar year 1999-2003, local, state and federal officials reported 9,160 seizures of methamphetamine labs, dumpsites and locations of inactive labs in Missouri – more than any other state in the nation. The prevalence of methamphetamine labs in the state, and the potential for injuries to responders and the general public related to these labs, demands that additional data be gathered regarding the public health impact of methamphetamine-related activities.

Several data sources were used to obtain notification and additional information regarding methamphetamine-related events. These sources included, but were not limited to, the MSHP Chemical Exposure Reports, the NRC, and DNR.

Missouri HSEES completed a three-year methamphetamine analysis for calendar years 1999-2001. Results from the analyses showed that PPE worn by responders is often inadequate and does not provide sufficient protection against adverse health effects. Additional PPE and increased awareness of the potential hazards of chemicals and processes used to produce methamphetamine are needed to reduce the adverse health effects resulting from these events.

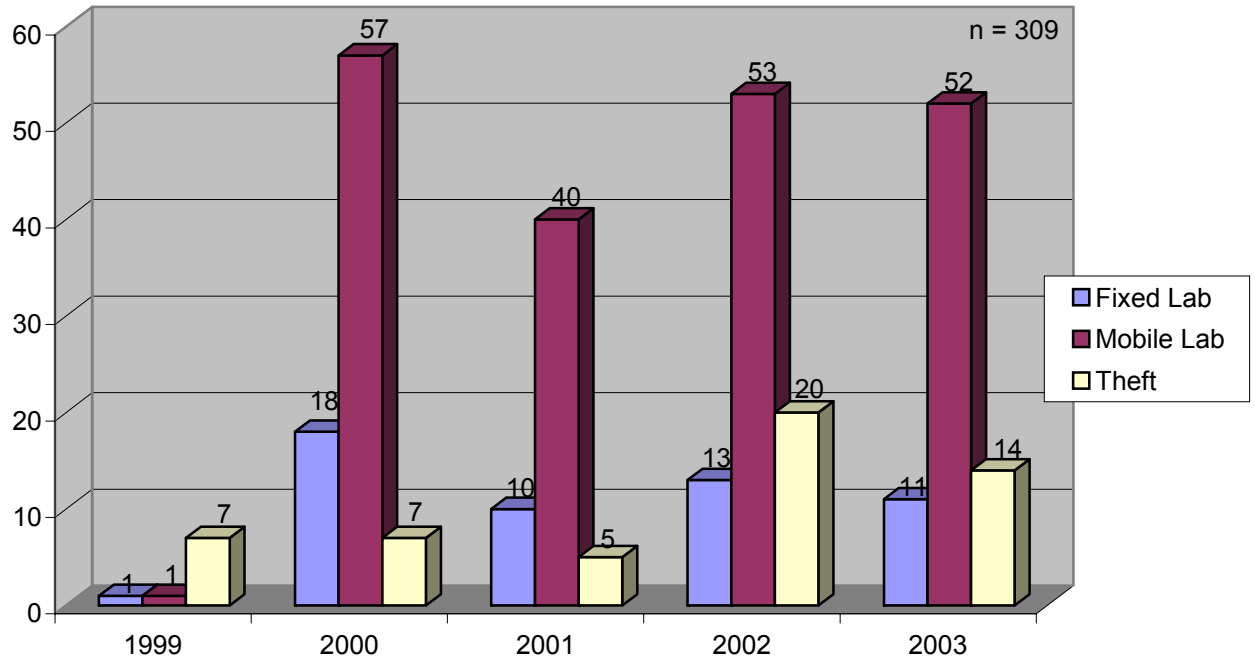
Missouri reported a total of 309 events related to methamphetamine for calendar years 1999-2003. The largest proportion of events occurred in fixed facilities (Table 7). Each methamphetamine event was categorized into the type of situation such as theft, fixed-lab (private residence, abandoned lab) and mobile lab. There were 203 (66%) fixed labs, 53 (17%) mobile labs and 53 (17%) events in which chemicals were stolen from an agricultural facility (Figure 7).

Table 7. - Methamphetamine related-events cumulative data by year, Missouri Hazardous Substances Emergency Events Surveillance, 1999-2003.*

Year	Type of event			No. substances involved	No. victims	No. deaths	Events with victims	
	Fixed facility	Transportation	Total				No.	%†
1999	8	1	9	9	10	0	2	.7%
2000	68	14	82	189	110	0	78	31%
2001	46	9	55	116	73	0	49	19%
2002	72	14	86	172	107	0	67	26%
2003	60	17	77	168	103	1	58	23%
Total	**254**	**55**	**309**	**654**	**403**	**1**	**254**	**99.7%‡**

***** Numbers in the table may differ from those reported in previous years because of adjustments in HSEES qualification requirements for events.
† Percentage of events with victims
‡ Does not equal 100% due to rounding

Figure 7. - Methamphetamine related-events situation, by year, Missouri Hazardous Substances Emergency Events Surveillance, 1999-2003.



A total of 654 substances were involved in all methamphetamine events, of which 2 (.3%) were reported as threatened releases. The substances most frequently released were ammonia, ethyl ether, hydrochloric acid, and methamphetamine chemicals not otherwise specified (NOS) (Table 8).

Table 8. - The 10 most frequent substances involved in methamphetamine events, Missouri Hazardous Substances Emergency Events Surveillance, 1999-2003

Number	Standardized Substance Name	Frequency
1.	Ammonia	163
2.	Ethyl Ether	103
3.	Hydrochloric Acid	76
4.	Methamphetamine Chemicals NOS*	56
5.	Acetone	43
6.	Phosphorus	42
7.	Acid NOS*	36
8.	Iodine	30
9.	Solvent NOS*	21
10.	Sulfuric Acid	15
	Total	**585**

*Not Otherwise Specified

These substances were grouped into 16 categories. The categories most commonly involved in fixed-facility events were volatile organic compounds (151, 28%), ammonia (143, 26%) and acids (115, 21%). In transportation-related events, the most common releases were volatile organic compounds (32, 31%), ammonia (20, 20%), and other (19, 18%) (Table 9).

Table 9. - Number of substances involved in methamphetamine events, by substance category and type of event, Missouri Hazardous Substances Emergency Events Surveillance, 1999-2003.

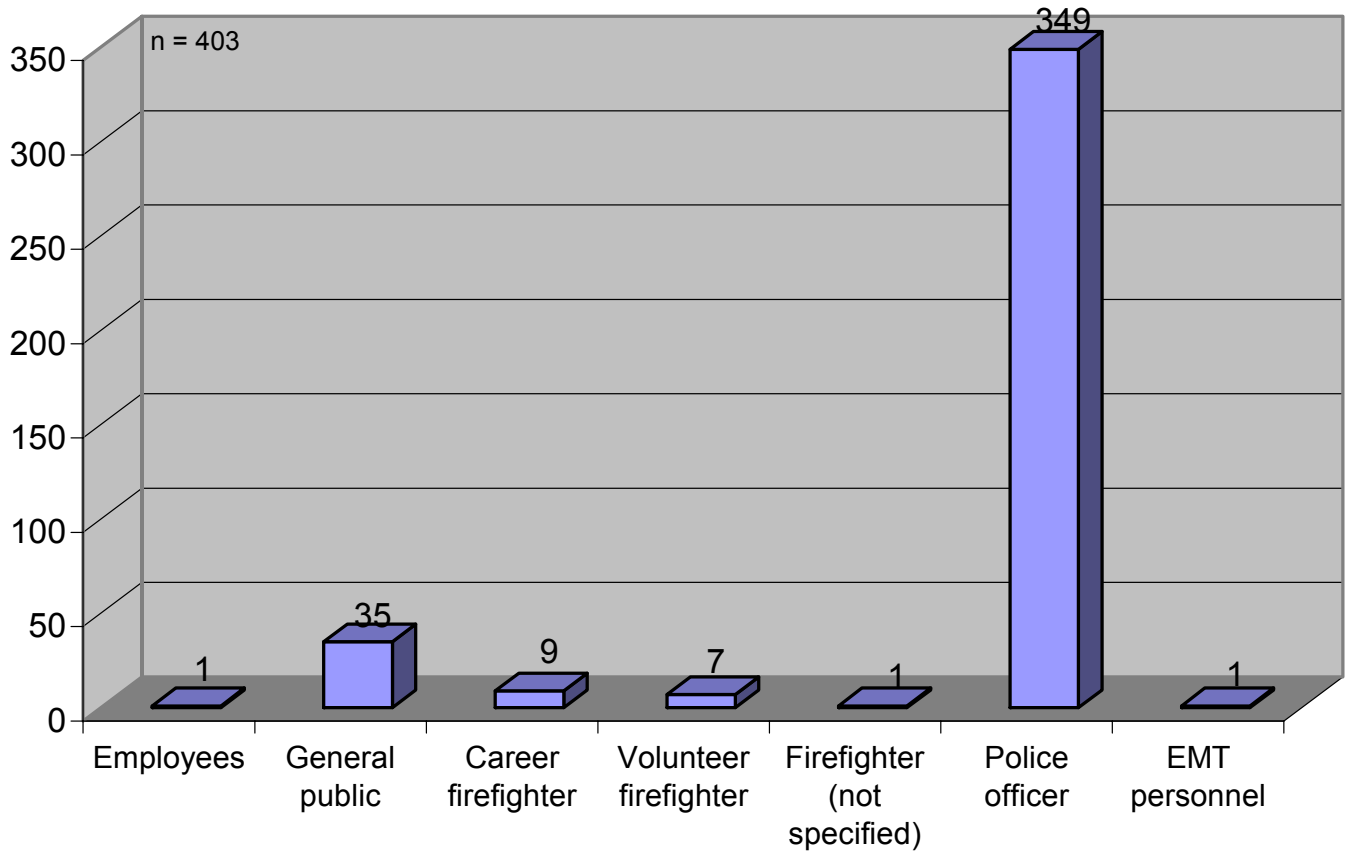
Substance category	Type of event				All events	
	Fixed facility		Transportation			
	No. substances	%	No. substances	%	No. substances	%
Acids	115	21%	13	13%	128	20%
Other*	55	10%	19	19%	74	11%
Mixture†	1	.2%	1	1%	2	.3%
Ammonia	143	26%	20	20%	163	25%
Bases	9	2%	3	3%	12	2%
Chlorine	0	0%	0	0%	0	0%
Other inorganic substances‡	76	14%	14	14%	90	14%
Paints & dyes	0	0%	0	0%	0	0%
Pesticides	0	0%	0	0%	0	0%
Polychlorinated biphenyls	0	0%	0	0%	0	0%
Volatile organic compounds	151	28%	32	31%	183	28%
Formulations	0	0%	0	0%	0	0%
Hetero-Organics	0	0%	0	0%	0	0%
Hydrocarbons	0	0%	0	0%	0	0%
Oxy-Organics	0	0%	0	0%	0	0%
Polymers	0	0%	0	0%	0	0%
Total	**550**	**+99.2%**	**102**	**101%**	**652**	**+100.3%**

* Not classified.
† Substances from different categories that were mixed prior to the event.
‡ All inorganic substances except for acids, bases, ammonia and chlorine.
+ Percentage does not equal 100% due to rounding.

Most substances during this time were released by air emissions (568, 87%). The remaining substances were released during spills (12, 2%), explosions (4, 0.6%) and fire (1, .01%) or a combination of two types of releases (67, 10%).

In the 254 methamphetamine events involving victims, respiratory symptoms consistently have been most frequently reported. The number of deaths associated with events continues to suggest the need to evaluate not only the danger posed by methamphetamine substances, but also the circumstances surrounding the events (e.g., insufficient personal protection against adverse health effects). Police officers continue to be the most commonly reported victims of methamphetamine emergency events (Figure 8).

Figure 8. - Number of methamphetamine-related victims by victim category, Missouri Hazardous Substances Emergency Events Surveillance, 1999-2003.



SUMMARY OF RESULTS, 1994-2003

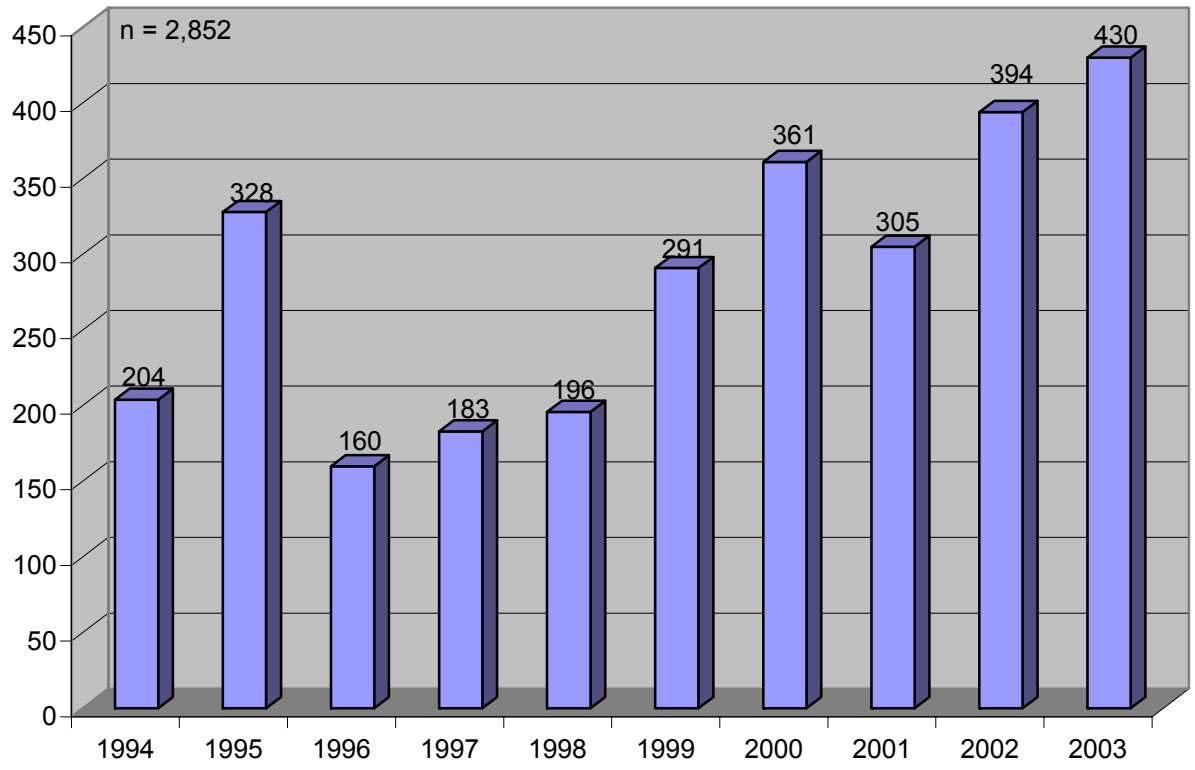
During 1994—2003, the largest proportion of events occurred in fixed facilities (Table 10). However, the number of reported transportation-related events is increasing. The increase is partially due to the utilization of the U.S. Department of Transportation's Hazardous Materials Information System as a primary notification source for transportation events. In addition, the total number of events continued to increase over time (Figure 9). The increase in the number of events may have been due, at least in part, to the expansion of reporting sources.

Table 10. - Cumulative data by year, Missouri Hazardous Substances Emergency Events Surveillance, 1994-2003.*

Year	Type of event			No. substances Involved	No. victims	No. deaths	Events with victims	
	Fixed facility	Transportation	Total				No.	%†
1994	137	67	204	231	32	1	15	3%
1995	172	156	328	360	13	1	9	2%
1996	109	51	160	175	59	2	12	2%
1997	113	70	183	216	23	1	13	2%
1998	145	51	196	197	24	2	17	3%
1999	166	125	291	312	71	3	23	4%
2000	199	162	361	486	197	14	103	19%
2001	145	160	305	369	157	3	79	15%
2002	201	193	394	501	307	5	127	24%
2003	225	205	430	575	217	3	135	25%
Total	**1,612**	**1,240**	**2,852**	**3,422**	**1,100**	**35**	**533**	****99%**

* Numbers in the table may differ from those reported in previous years because of adjustments in HSEES qualification requirements for events.
† Percentage of events with victims
**Percentage does not equal 100% due to rounding.

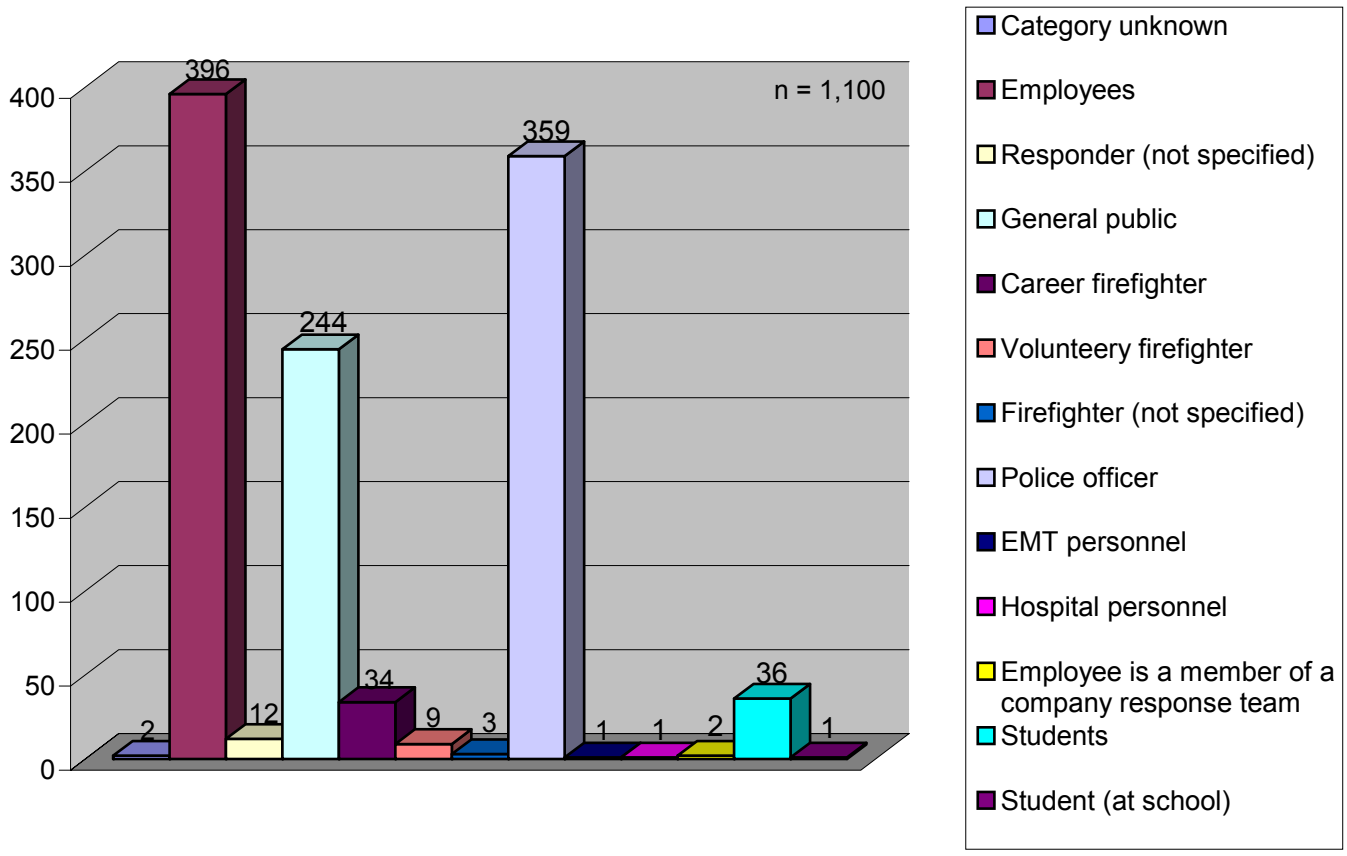
Figure 9. - Cumulative data by year, Missouri Hazardous Substances Emergency Events Surveillance, 1994-2003.*



In events involving victims, respiratory symptoms consistently have been most frequently reported. The number of deaths associated with events continues to suggest the need to evaluate, not only the danger posed by exposure to hazardous substances, but also the circumstances surrounding the events (e.g., a crash resulting from high-speed travel of a truck transporting an ammonia tank). Employees continue to be the most commonly reported victims of emergency events. However, members of the general public, responders, and students constitute a large proportion as well (Figure 10).

The findings from the HSEES data analyses regarding the proportions of the number of events with victims and events with evacuations and the distributions of the numbers and types of injuries reported have been consistent over time.

Figure 10. - Number of victims by victim category, Missouri Hazardous Substances Emergency Events Surveillance, 1994-2003.



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1. Centers for Disease Control and Prevention: Comprehensive plan for epidemiologic surveillance. Atlanta: US Department of Health and Human Services; (1986).

2. Binder S. Death, injuries, and evacuations from acute hazardous materials releases. Am J Public Health 1989; 70:1042-4.

Appendix A. - The 10 most frequent substances involved in events, Missouri Hazardous Substances Emergency Events Surveillance, 2002-2003

Number	Standardized Substance Name	Frequency
1.	Ammonia	138
2.	Hydrochloric Acid	71
3.	Ethyl Ether	38
4.	Acetone	36
5.	Paint	34
6.	Sodium Hydroxide	34
7.	Sulfuric Acid	34
8.	Mercury	31
9.	Methamphetamine Chemicals NOS*	31
10.	Phosphorus	28
	Total	**475**

*Not Otherwise Specified